Ohio Agricultural Experiment Station

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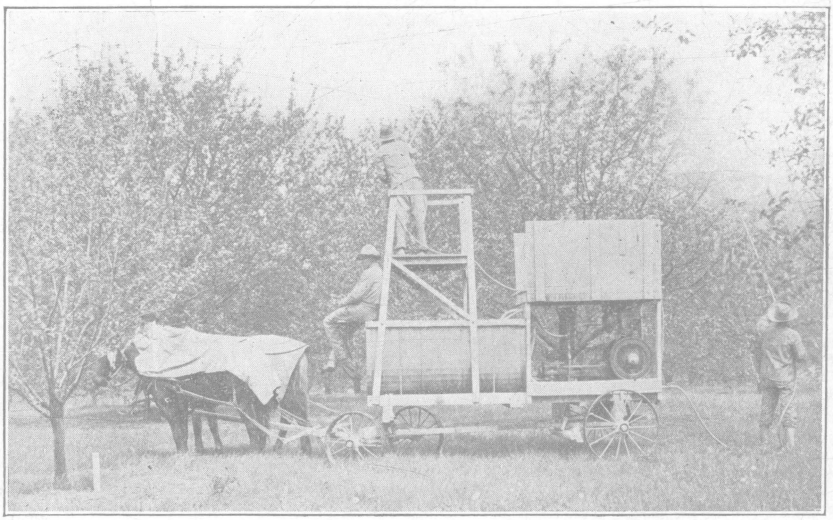
COMMERCIAL APPLE ORCHARDING IN OHIO



Spraying in the Station apple orchard

Photo by Beeching

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COMMERCIAL APPLE ORCHARDING IN OHIO

By H. A. GOSSARD

In 1907 the writer commenced a series of apple spraying tests in Ohio to determine if western methods of spraying could be adapted to Ohio orchards and what combinations of chemicals were best suited to our conditions. An account of the results of the work for the season of 1907 was given in Bulletin 191 and excited widespread interest. From 12 acres of bearing trees less than 20 years old, 2,500 bushels of apples were picked, most of them being sold at $3.50 per barrel, the buyers furnishing the barrels and doing the barreling. Several hundred bushels were sold at $1.50 per bushel. About 25 acres in total of bearing apple trees were possesed by Messrs. Schmitkons and from these were harvested that season approximately 4500 bushels of apples which yielded a gross return of $4,800.00. The net return for the year was easily over $4,000.00, over one-half of which was due to spraying, as proved by the comparative results from sprayed and unsprayed trees on which careful records were kept.

The following year we continued our experiments in an orchard of 14 acres belonging to Mr. J. A. Stokes and located near the village of Erlin in Sandusky county. The results of this test were detailed in Circular 95 and excited much attention and comment throughout the eastern states. Some of our Ohio orchardists had known for years that the possibilities of apple production in Ohio compared favorably with the best in the world, but, for the first time, apparently, the masses of Ohio fruit growers began to suspect that they did not need to go to the far west in order to produce the highest quality of apples in as great quantities per acre as could be produced in famous apple districts elsewhere. From this orchard of 14 acres was gathered 1,650 barrels of fruit, besides which, from 200 to 300 bushels were sold locally as summer apples at the nearby towns, to neighbors, etc., a carload of drops was sold in bulk at 65 cents per 100 pounds and a considerable quantity was made into cider. The gross income from the orchard for the season was approximately $7,400.00. It is a very conservative estimate to say that from $5,500.00 to $6,000.00 or more of this return was net and that the average net return per acre was between $400.00 and $500.00. From 55 Ben Davis trees, 24 years old, were picked 396 barrels of apples. Since these trees were 33 feet apart, each way, 40 trees should be allowed per acre. The average yield per tree

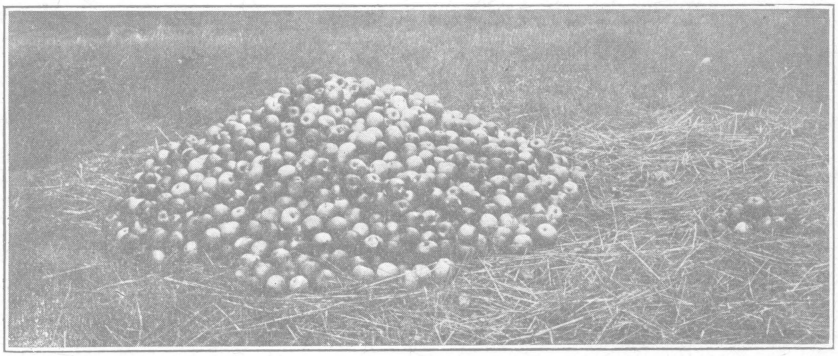
was 7.2 barrels, or an acre at this rate yielded 288 barrels. On an average, seven-eighths of these or 252 barrels were classed as "firsts" and sold at $5.00 per barrel. One-eighth or 36 barrels were classed as "seconds" and sold for $3.00 per barrel. All of this barreled product was put in cold storage in Cleveland and sold at spring prices. The value of the drops ran about $1.00 per tree. The total receipts therefore from this acre was $1,408.00 as closely as can be estimated. After making all allowances for care, spraying, trimming, harvesting, barreling and storing, the net profit exceeded $1,000.00 from this acre and this with only ordinary packages and methods of marketing. There was no selection of trees nor "gerrymander" of any sort to get this acre. Every Ben Davis tree in the block with the exception of one replant, too young and small to be fairly considered, was included in the count, and the estimate was computed from one and three-eighths acre and not from less than an acre. The writer and Mr. W. H. Goodwin were present during nearly the whole of the apple harvest and can vouch for the correctness of the record. The striking results obtained in these experiments stimulated all the agricultural educational agencies in the state to increase their facilities for carrying forward orchard demonstration work, and contributed much to the revival of apple orcharding in Ohio. The most successful demonstration tests since made have employed substantially the same methods of application of the sprays that were used in these orchards.

SUBSEQUENT TESTS

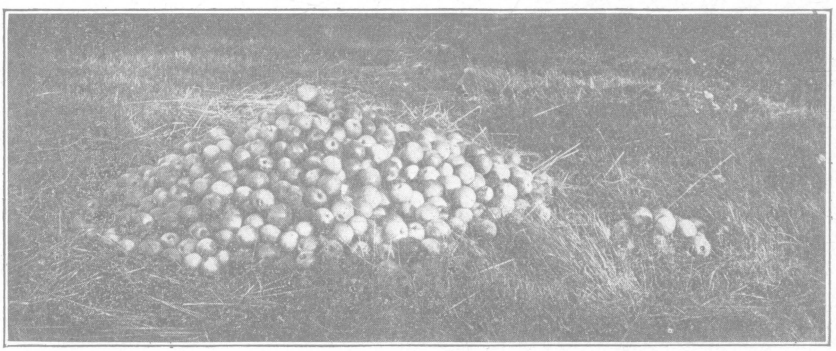
In order to determine how far these results were to be considered representative or far exceptional, I decided to begin the next year a series of long term tests, using the same orchards through a succession of years so as to secure an average result, and thus give to the prospective orchardist some reliable basis upon which to compute the probable returns on an orchard investment.

The three Departments of Horticulture, Entomology, and Botany arranged a cooperative program in 1909, by which it was hoped to carry spraying demonstrations into several different localities of the state and at the same time determine what combinations of sprays were best suited to Ohio conditions. Questions relating to rejuvenation of old orchards and other distinctively horticultural problems have, so far as possible, been left to the Horticultural Department and those relating to fungous diseases and fungicidal sprays to the Department of Botany, but in the nature of the case each of the Departments has been obliged to trespass to some extent upon the distinctive spheres of the other two. For instance, we have had to do considerable rejuvenation

work in some of the orchards we are testing to put them in any sort of condition to stand a commercial test. The only orchards which were in condition to show from the beginning the true commercial possibilities of Ohio orcharding were those belonging respectively to the Messrs. Schmitkons, to Mr. Stokes, and to the Experiment Station. All these had been cared for with skill and intelligence for several years previous to the commencement of our experiments in them, having been manured, pruned, mulched, and sprayed with barrel outfits or compressed air machines, as a regular practice. These were, therefore, ready to respond at once to thorough spraying with power outfits.

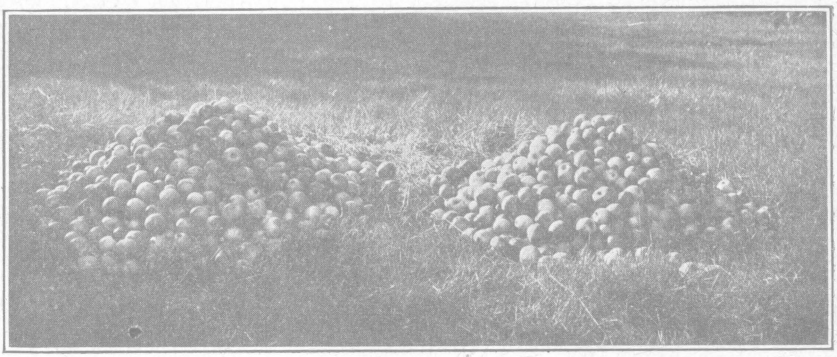


Sound 2,890 Wormy 15
Wormy .51 percent
Sound 16 bushels Wormy 1-12 bushel
Baldwin. Schmitkons orchard. Sprayed twice with lime-sulfur followed with arsenate of lead. Sprayed again with arsenate of lead in late July



Sound 1,181 Wormy 20
Wormy 1.6 percent
Sound 9 bushels Wormy 1-8 bushel
Ben Davis. Schmitkons orchard. Two sprayings after bloom with lime-sulfur and arsenate of lead and again with arsenate of lead alone in late July

NOTE: In all cases illustrations show only the crop of picked fruit, while numerical records include drops or windfalls in every case.



Sound 1,021 Wormy 1,081

Wormy 51.4 percent

Sound 8 bushels Wormy 7 bushels

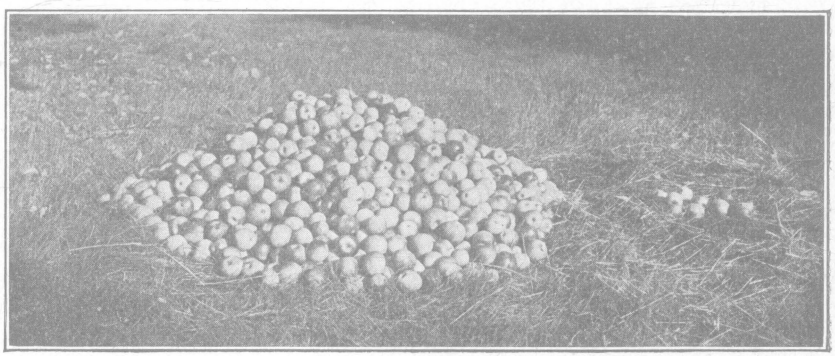
Ben Davis. Schmitkons orchard. No poison spray

RECORD OF SCHMITKONS ORCHARDS

The Schmitkons orchards in Lorain County have the following record for the past four years:

NUMBER OF ACRES IN BEARING, 25

Year	Approximate number of bushels produced	Approximate gross income	Approximate gross income per acre
1907	4,500	$4,800.00	$152.00
1908	1,500	1,000.00	40.00
1909	4,000	3,000.00	120.00
1910	3,500	3,500.00	140.00
Average result per year for 4 years	3,375	$3,075.00	$113.00



Sound 1691 Wormy 26

Wormy 1.51 percent

Sound 12 bushels Wormy 1-10 bushel

Ben Davis. Schmitkons orchard. Two sprayings after bloom with Bordeaux and arsenate of lead. Sprayed with arsenate of lead only in late July

These orchards are planted in a rather sheltered location about five miles from the shore of Lake Erie on quite low land. Without tile drains which are regularly laid through these orchards, the

ground would be far too wet to bring any sort of satisfactory results. Many Ohio orchards which are doing little or nothing are better located, and with the same sort of care would make as good or better records. The light crop of 1908 was probably due to a prolonged drought coinciding with the heavy crop of the preceding summer. The results given are below, rather than above the real returns. After allowing for the expense of trimming, spraying, mulching, picking, barreling and storing, fully 70 percent or more of the gross returns are certainly to be counted as net. The owners of these orchards keep bees which practically insure proper pollination of the blossoms.

RECORD OF THE STOKES ORCHARD

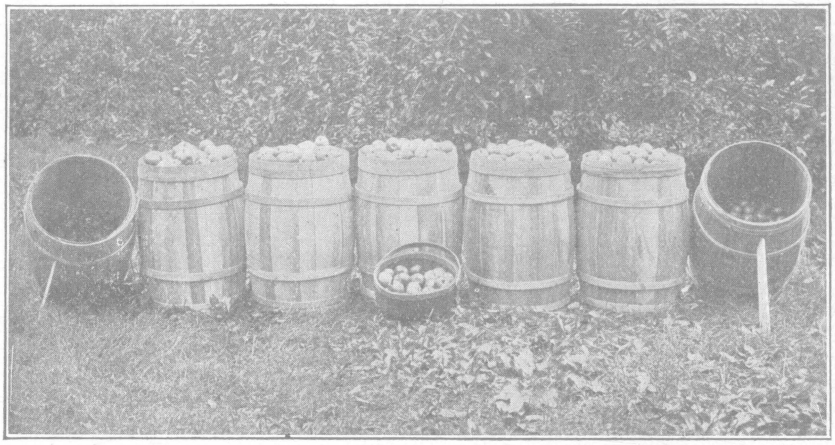
The record of the Stokes orchard of 14 acres for the past three seasons is approximately as follows:

Year	Approximate number of bushels produced	Approximate gross income	Approximate gross income per acre
1908	5,600	$7,400.00	$528.50
1909	4,000	4,666.67	333.33
1910	5,660	5,962.84	425.92
Average result per year for 3 years	5,086	$6,009.84	$429.25

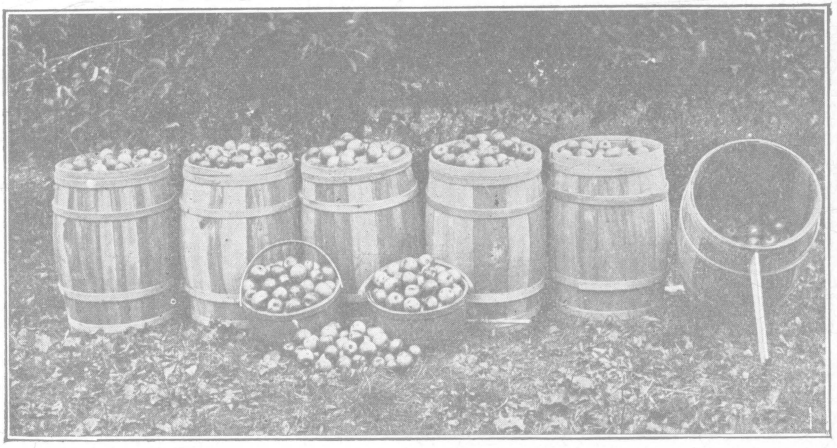
For the years 1909 and 1910 I have only the yield in bushels and from this have estimated the income, assuming the average price to have been $3.50 per barrel. Mr. Stokes expressed a preference that the exact returns in cash be not reported and we deem the estimate given sufficiently accurate for our purpose. I have good reasons for thinking it to be well within the actual returns. Since a considerable part of these apples were put in cold storage each year, thereby increasing the expense of handling, I will, for safe measure, deduct 35 percent for expenses and estimate 65 percent of the returns to be net. The record given does not take into account several hundred bushels which were used in 1909 for making cider. That year there were enough more than given in the estimate to make 20 barrels of cider. Of the total yield for 1910, 700 bushels were cider apples, which I have included in the estimates as being worth 25 cents per bushel.

In 1909 a solid acre of Baldwins was selected and a record was made of the yield from the 40 trees, all trees in the block, both good and bad being included. The yield from this acre was 265 barrels, or a little short of the record of 288 barrels picked the preceding year from the Ben Davis acre. At $3.50 per barrel, the gross earnings from this acre were $927.50 and the net return must have been easily $750.00 or more. These orchards are well located on

strong soil and have been given excellent care from the time when they were first planted. They well represent the high possibilities of Ohio orcharding if careful attention is given to all phases of the business from the beginning of the orchard. These and many other Ohio orchards, if similarly treated, will compare very favorably with the best orchards in any part of the United States. Mr. Stokes is also a bee-keeper.



Ben Davis. Stokes orchard. Two sprayings after bloom with Bordeaux and arsenate of lead
Sound 3,180 Wormy 88
Sound 18 bushels Wormy 1-2 bushel
Total wormy 2.69 percent
Wormy apples in the basket



Ben Davis. Stokes orchard. No poison spray
Sound 3,662 Wormy 439
Sound 16 1-2 bushels Wormy 1 1-4 bushels
Total wormy 10.7 percent
Wormy apples in the baskets and the small pile

For the past two years the Department of Entomology has sprayed the orchard of the Experiment Station, making special use of a 6-acre block, 16 or 17 years old. This block is situated on rather high ground and the effect of the prolonged drought in the summer and fall of 1908 showed itself plainly in the light crop of 1909. This is a variety orchard, not wholly suited for a commercial test, and will be sprayed the coming season and in the future by the Department of Horticulture. This orchard, like the two previously reported, was in excellent condition when we commenced work on it.

RECORD OF SIX ACRES

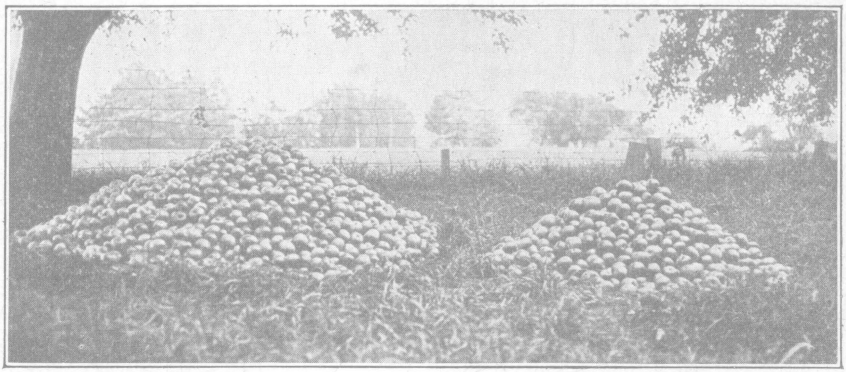
Year	Approximate number of bushels produced	Approximate gross income	Approximate gross income per acre
1909	629	$ 606.85	$101.14
1910	1,900	1,900.00	316.67
Average result per year for 2 years	1,264.5	$1,253.43	$208.90

Much of the produce of this orchard has been used for exhibition purposes at State and County fairs and apple shows, and the figures given represent the income that would have been realized had the entire product been sold at the prices that were received for the fraction of the crop that was marketed. The crop for 1909 was 545.6 bushels of picked fruit and 83.4 bushels of drops. The No. 1 apples brought $1.25 per bushel and the No. 2's brought 75 cents. As nearly as can be determined, the results given represent the income if the orchard had been handled as a purely commercial proposition. The quality and beauty of this fruit compared very favorably with the best that can be grown anywhere, as is well known by all who inspected the exhibit of the Experiment Station at the Ohio apple shows of the past two winters.

RECORD OF A FAMILY ORCHARD

A small family orchard near Wooster, belonging to Mr. A. A. Mowery, consisting of about 90 bearing trees upwards of 40 years old, and scattered over about 4 acres of ground, has done fairly well in spite of the fact that it had not been sprayed, trimmed, or given scarcely any attention for several years. The land in this orchard originally supported 40 trees per acre. The location is good. During both years in which we sprayed it, only one spraying was given after the bloom fell. Its record is as follows:

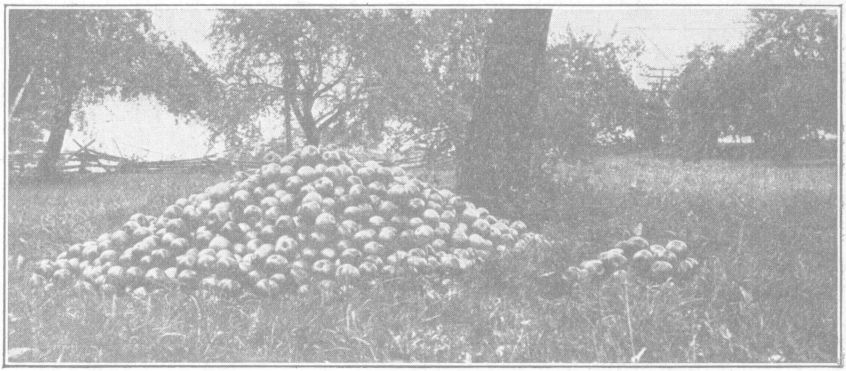
Year	Approximate number of bushels produced	Approximate gross income	Approximate gross income per acre
1909	877	$845.00	$211.25
1910	670	475.00	118.75
Average result per year for 2 years	773.5	$660.00	$165.00



Sound 3,895 Wormy 2,036
Wormy 21 percent
Sound 25 bushels Wormy 5 bushels
Janet. Derthick orchard. No poison spray.

RECORD OF DERTHICK ORCHARD

Three other orchards have been under test for two years but none of these was in such shape at the beginning of the spraying as fairly to be regarded as representative Ohio orchards. One of 14 acres and more than 40 years old, located in northeastern Ohio, belonging to Mr. F. A. Derthick, Mantua, Ohio, had been defoliated for several successive seasons by canker worms and had not been sprayed or thoroughly trimmed for several years. Blight and collar-rot were very prevalent, and only 389 trees remained standing.

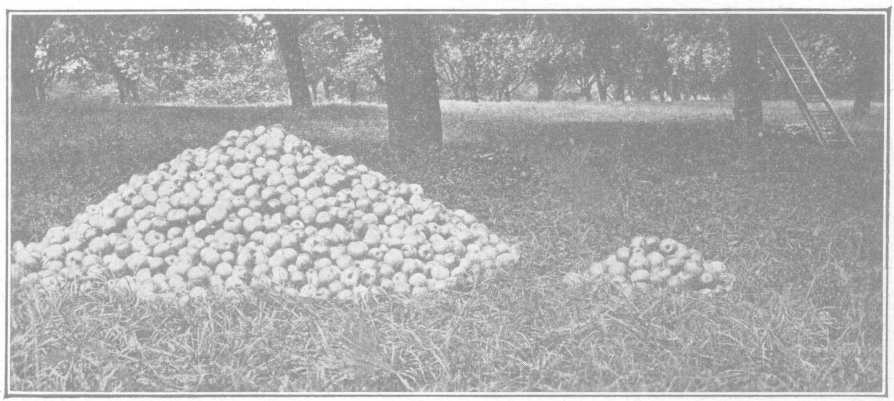


Sound 1,951 Wormy 66
Sound 9 bushels Wormy 1-4 bushel
Wormy 3.27 percent
Janet. Derthick orchard. Two sprayings after bloom with Bordeaux and arsenate of lead, 3-3-6-50 formula

In the spring of 1909 the trees were banded with tree tanglefoot in March, and the females of both the fall and the spring species of canker worm were trapped in enormous numbers. Three bands, aggregating in width 12 to 15 inches, were required on some of the trees to stop the ascent. From 8 to 12 females per square inch were caught and, by computation, from 8,000 to 1,4000 of these were trapped on some of the worst infested trees. Notwithstanding these bands, a multitude of worms, apparently of the fall species, hatched and began feeding on the leaves as soon as they unfolded. A heavy spraying with arsenate of lead, before bloom, practically exterminated them, and the trees kept in fair foliage throughout the season.

The record for the two years is as follows:

Year	Approximate number of bushels produced	Approximate gross income	Approximate gross income per acre
1909	600	$ 400.00	$28.57
1910	1,450	1,000.00	71.57
Average result per year for 2 years	1.025	$ 700.00	$50.07



Sound 4011 Wormy 137

Wormy 3.3 percent

Sound 19 1-2 bushels Wormy 5-8 bushel

Janet. Two sprayings after bloom with lime-sulfur, 1 gallon in 30 of water with 2 1-2 lbs. of arsenate of lead added to each 50 gallons.

For the year 1909 we have estimated the entire crop, both of No. 1's and No. 2's, as being worth 75 cents per bushel. In 1910, 450 barrels of fruit were sold at $2.00 per barrel, the buyers furnishing the barrels. About 100 bushels were kept for home consumption and neighborhood sales, and something like 150 bushels of cider

apples were sold at 20 cents per bushel. The crop from this orchard was worthy of a better price. From 75 to 80 percent of the returns should be considered net. From any fair standpoint, the work of the past two years in this orchard should be considered rejuvenation work, as the orchard is just now sufficiently recovered from the effects of defoliation through several successive seasons to fairly show what it is worth and what such neglected orchards can become. Next year's crop ought to prove more representative.

ORCHARDS IN SOUTHEASTERN OHIO

An orchard of about 40 acres in Gallia County has been under test as a type of the hill orchards of southeastern Ohio. This orchard had not been sprayed for several years, and apparently owing to this and to the drouth of 1908, it was unable to hold its crop in 1909, only a small quantity being produced. The income was not enough to pay for the care of the orchard. Much work was done in trimming, cleaning out the briars, mulching it, etc. It was apparently in good condition to bear a crop in 1910, and a good return would in all likehood have been obtained except for the freeze which came in May and destroyed every prospect in the orchard. Not a dozen apples were produced. An attempt was made to warm the air by burning heaps of brush trimmings which had been saved and piled for this purpose, but the high wind with driving rain and sleet put out the fires as fast as they were lighted. Whether or not any sort of orchard heaters would have proved of much value under such conditions is questionable, and the two years' record from this orchard must be written down as a failure.

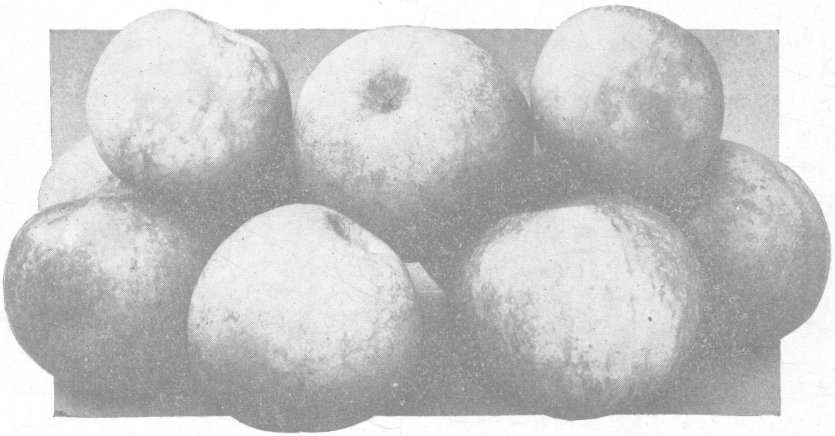
Another orchard of 40 acres in Jackson county has a record quite similar to the last. In 1909 there was a small crop, enough to pay for the cost of maintenance and a very slender profit besides, but no crop at all was produced in 1910 because of the same freeze that destroyed the crop in the Gallia county orchard.

The Department of Horticulture is testing various systems of orchard heating and there is no apparent reason why these should not prove as successful and profitable in Ohio as they have done elsewhere. Before Ohio is on a level competing basis with other sections, her orchardists must learn how to overcome these frosts and freezes like their competitors have done.

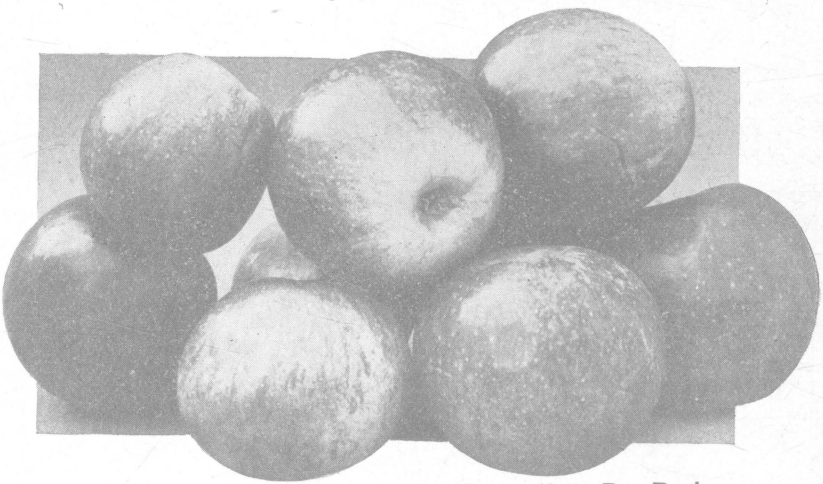
RECOMMENDATIONS AS TO SPRAYING PROCEDURE

The conclusions regarding best spraying procedure, so far as agreed upon by the three Station Departments cooperating in these experiments, have been stated in Circular 109. The Department of Entomology, operating largely in the northern part of Ohio and working chiefly with varieties not specially susceptible to scab or

bitter rot, obtained very satisfactory results from the use of lime-sulfur solution as a summer spray and, for such conditions as prevailed in these orchards, we prefer this before any other mixture tried. No bad effects have been noticed from combining it with arsenate of lead, and it causes distinctly less russeting to fruit and less injury to foliage than any other spray we have tried.



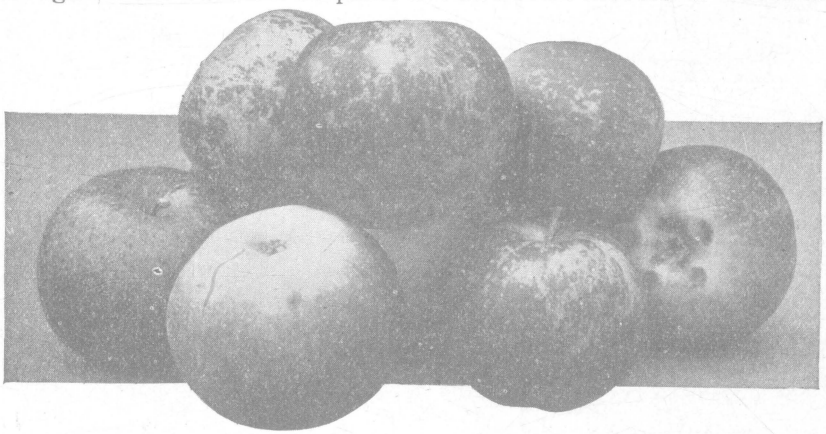
Russeted fruit. Sprayed with Bordeaux. Ben Davis



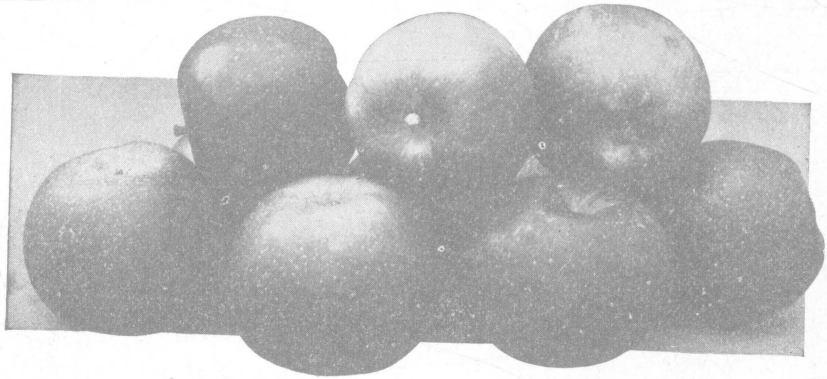
Smooth fruit. Sprayed with dilute lime-sulfur. Ben Davis

However, severe russeting and cracking of fruit may follow the use of this combination, and variety is an important factor in determing the degree of damage, exactly as is the case with Bordeaux. Last year, in the Station variety orchard, trees standing in the same row and sprayed from the same tankful of mixture, only a few minutes

apart, exhibited all grades of russeting from perfect, unblemished fruit to apples as badly cracked as could be found in the plots sprayed with other mixtures. On the average, however, the amount of injury was insignificant as compared with that resulting from the use of the other sprays. There should be two sprayings before bloom, one with lime-sulfur solution, winter strength, before the leaves appear, to destroy scale insects and the hibernating forms of many other species; and another with weak Bordeaux mixture or its equivalent after the leaves are unfolded and just as the bloom begins to show pink. If aphids are abundant at this time use lime-sulfur solution diluted with 30 parts of water instead of Bordeaux for this application. As soon as the bloom has fallen, spray heavily with lime-sulfur solution and arsenate of lead. We use the commercial lime-sulfur solution, testing about 33 degrees Beaume, diluted with 30 to 40 parts of water and two pounds of arsenate of lead is used in each 50 gallons of spray. The effect of this spray throughout the summer on plant lice and scale insects is excellent.



Russeted fruit. Sprayed with Bordeaux. Baldwin



Smooth fruit. Sprayed with lime-sulfur. Baldwin

Some of the deformities on apples are due to injury initiated by plant lice, especially the wooly louse, and these malformed fruits were comparatively scarce in the plots sprayed with the lime-sulfur as summer practice. A second spraying with lime-sulfur and arsenate of lead combined should be given about ten days after the falling of the bloom, or it may be given about the middle of July to forestall the second brood of worms. We find practically no difference in the percentage of wormy apples at harvest time in case of the two sprays following close after the bloom, or one of them being deferred till July or early August. If these sprayings are properly made, from 95 to 99 percent of the apples will be free from worms at harvest time. This statement is supported by all the tests tried except the one in the Experiment Station variety orchard. Owing to the unevenness in the time of blooming in this orchard, thus compelling us to work on the best average date of development, therebyanticipating the best spraying date for a few varieties and passing it too long for most, we were never able to avoid from 5 to 25 percent of wormy fruit,with an average of 10 to 15 percent, not withstanding the most thorough treatment.

We still follow substantially the same methods of application described in Bulletin 191 and Circular 95. We prefer a high pressure, from 150 to 200 lbs., to expedite work and insure thoroughness of application but have obtained almost equally good results with 80 to 100 pounds pressure by remaining enough longer with each tree to more than equalize the amount of liquid used.

Thus far we have preferred the large disc types of nozzles or else something approaching the vermorel clusters, such as a spramotor ring cluster of about six nozzles, rather than the Bordeaux types which give more or less of a straight, driving, stream spray. We think we can work faster with the former, secure a more uniform distribution of the fungicide over the foliage with less waste of liquid, apparently cause less damage to the tender skin of the young fruit from impact of the caustic spray against it, thus getting less of russeting, and at the same time get a sufficiently high percentage of sound fruit to be satisfactory.

It has seemed desirable to summarize at this time these quantitative results and main conclusions regarding procedure, without going into full details regarding the entomological data accumulated.

The entire assistant staff of the Department of Entomology have for the past four years been identified with this work, each assistant supervising the work in one or more orchards. The illustrations used in this Circular and the explanatory details accompanying them have been furnished by Mr. W. H. Goodwin.

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